

steel quiz

Steel Quiz made its first appearance in the November 1995 issue of *Modern Steel Construction*. This month's Quiz takes a look at some of the best questions from 1997.

- 1 The torsional constant J can be accurately approximated for W-shapes and similar shapes of open cross section as $\Sigma(bt^3/3)$ where b and t are the width and thickness of each element, respectively. Does this simple approximation also work for a hollow structural section (HSS)? Hint: See Figure 1.

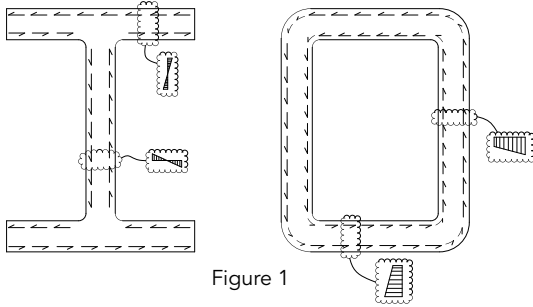


Figure 1

- 2 Which of the following ASTM Specifications is a production specification and not a material specification?
- a. ASTM A992
 - b. ASTM A36
 - c. ASTM A6
 - d. ASTM A709
 - e. None of the above
- 3 Name three common sources of residual stress.

- 4 Philosophically, what is the difference between a filler and a shim?
- 5 In laboratory testing of steel specimens, what is whitewash and what does it do?
- 6 A structural member has been properly designed to meet all applicable load and strength criteria. Can it be said that this member will never fail? Hint: See Figure 2.

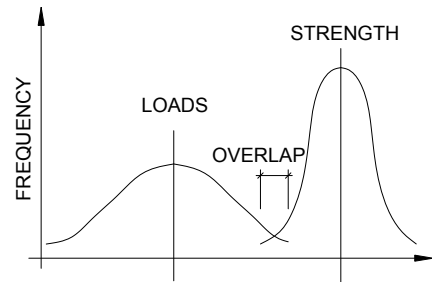


Figure 2

- 7 Why are beveled washers square or rectangular but not round?
- 8 What is a leaning column?

TURN PAGE FOR ANSWERS

- 1 No, because the mode of torsional resistance differs. Open cross sections resist torsion with in-plane shear stresses that vary linearly across the thickness of each element of the cross section, as illustrated in Figure 1 (on the previous page) for a W-shape. Closed cross sections resist torsion with shear stresses that are distributed over the thickness of the cross section for a rectangular HSS (the right side of the figure). See AISC Design Guide 9: *Torsional Analysis of Structural Steel Members* for more.
- 2 c. ASTM A6 covers the cross-sectional dimensions and production tolerances for hot-rolled structural shapes. The others listed cover various material grades, including material tensile properties and chemistries.
- 3 Common sources of residual stress include: cooling after rolling, cold bending and weld shrinkage.
- 4 A filler is furnished to occupy spaces that will be present because of dimensional separations between elements of a connection. For example, a filler is used in a flange-plated column splice when wide-flange columns are of differing sizes. A shim is furnished for use during erection to fill spaces that may or may not be present because of the required field assembly clearances. For example, shimming may be required with moment end-plate connections for which the beam is typically fabricated short by a small erection clearance.
- 5 Whitewash is a mixture of lime and water—a paint with no binder—that is applied to a steel assembly that will be tested. In areas of yielding during testing, mill scale (tightly adherent surface rust) is released. When coated with whitewash, the mill scale flakes, taking the whitewash with it, and visually distinct patterns of yielding result.
- 6 No, but it can be said that the risk of failure is acceptable by common standards. As illustrated in Figure 2 (on the previous page), the statistical distributions of load and strength will always overlap by some amount. Our design methods reduce this statistical overlap so that the risk of failure is acceptably low.
- 7 Beveled washers are used to compensate for a lack of parallelism between the outer faces of a bolted joint as is found in such cases as a joint involving the flange of an S-shape. To do so, the beveled washer must be properly oriented in the assembled joint. The square or rectangular shape simplifies proper orientation during installation.
- 8 A column that is pinned at its top and bottom and does not contribute to the strength or the stability of the frame is known as a leaning column.